

#1



**BIOLOGY
EOC
REVIEW CARDS**

Name: _____

Scientific Method & Experimental Design

#2

1. Question
2. Hypothesis
3. Testing (Observations & Controlled Experiments)
4. Conclusions (Support or Reject Hypothesis)



Independent Variable -- scientist changes (X axis)

Dependent Variable -- what is measured (Y axis)

Important Organic Compounds

#3

Carbohydrates (CHO)

- sugars, starches, cellulose
- energy
- Monomer = glucose
- - Polymer = starch

Proteins (CHON)

- enzymes, hair, collagen
- regulate cell processes
- Monomer = amino acids
- Polymer = polypeptides (proteins)

Lipids (CHO)

- fats & oils
- energy, cell boundaries
- Monomer = glycerol & 3 fatty acids

Nucleic Acids (CHONP)

- DNA or RNA
- carry hereditary information & instructions to make proteins
- Monomer = nucleotides

Remember -- Monomers combine to make Polymers (small to big)

Prokaryotic vs. Eukaryotic

#4

No Nucleus

No membrane bound organelles

ex) Bacteria

They do have

- 1) Plasma Membrane
- 2) DNA & RNA
- 3) ribosomes
- 4) cell wall
- 5) cytoplasm

Have a nucleus

Have membrane bound organelles...
mitochondria, chloroplasts, etc.

ex) Protist, Algae, Fungi, Plants, Animals

Important Cell Organelles #5

Organelle	Function	Prokaryotic or Eukaryotic	Plant or Animal
Nucleus	Control Center	Eukaryotic	Both
Plasma Membrane (cell membrane)	Control passage into/out of cell	Both	Both
Cell Wall	Support & Protection	Both	Plant (& fungi & bacteria, & some protists)
Mitochondria	powerhouse, Make ATP (energy)	Eukaryotic	Both
Vacuoles	Storage & Support	Eukaryotic	Both (small in animal, large in plant)
Chloroplasts	Photosynthesis, make food	Eukaryotic	Plants
Ribosomes	make proteins	Both	Both

Movement of Materials Into/Out of Cell

#6

Active Transport -- against gradient from low to high, requires energy

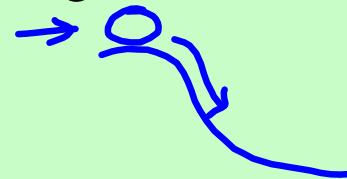


Passive Transport -- with gradient from high to low, NO energy required

↳ ex) Diffusion - any particle

Osmosis - water only

Facilitated Diffusion - uses protein channels



How will water move?

#7

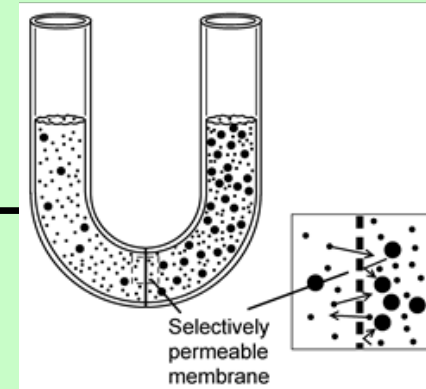
1) 40 % sucrose on Side A

→ 60% H₂O

60 % sucrose on Side B

→ 40% H₂O

Side A Side B



2) 55 % glucose on Side A

↳ 45% H₂O

35 % glucose on Side B

↳ 65% H₂O

3) 60 % salt on Side A

60 % salt on Side B

H₂O moves
in both
directions

Enzymes

#8

end in -ASE

proteins

speed up (catalyze) chemical reactions by lowering activation energy (amount of energy needed to start reaction)

very specific (lock & key)

Enzymes are recycled & reused

Denatured (change shape) by high temperatures & pH changes (use buffers to maintain pH)

Photosynthesis

#9

Sunlight to food (glucose)

Happens in chloroplast

requires chlorophyll (pigment that absorbs light)

Autotrophic Nutrition

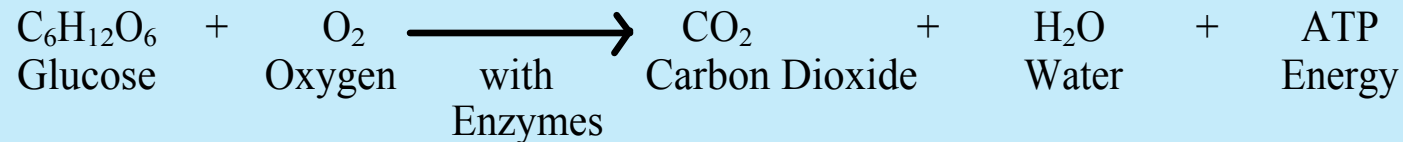


[Chemosynthesis -- uses chemicals (instead of sun energy) to make food; certain bacteria]

Cellular Respiration

#10

Food (glucose) to ATP (mitochondria)



Aerobic - Requires Oxygen - Total of 36 ATP

1. Glycolysis (2)
2. Krebs's Cycle / Citric Acid Cycle (2)
3. Electron Transport Chain (32)

Anaerobic - Without Oxygen - Total of 2 ATP

1. Glycolysis (2)
2. Fermentation
 - a. Bacteria/Animals - lactic acid
 - b. Yeast (Fungi) - alcohol & CO₂

DNA vs. RNA #11

- Deoxyribonucleic Acid

- Double Helix (2 strands)

- A, T, C, G

Rules: A--T and C--G

Replication: DNA copies itself
-happens during interphase
-semi-conservative: use old strand to make new strand

- Ribonucleic Acid

- 1 strand

- A, U, C, G

Rules: A--U and C--G

mRNA leaves the nucleus, goes to the ribosome to direct protein synthesis

tRNA - transfers amino acids to ribosome

Protein Synthesis #12

- happens at the ribosome

1. Transcription: DNA to mRNA in nucleus
2. mRNA leaves the nucleus, travels to ribosome
3. Translation: tRNA anticodon carrying amino acid is attached to each mRNA codon [look for start (AUG) & stop codon (UAA, UAG, UGA)]
4. amino acids are joined together by peptide bonds

Sexual vs. Asexual Reproduction ^{#13}

used to produce offspring
(children)

2 parents contribute DNA

Insures variety within species

Offspring are genetically
unique

ex) meiosis & fertilization

used for growth & repair

1 parent only...no mate needed

offspring are genetically identical

NO genetic variation

ex) mitosis, binary fission, budding, cloning,
regeneration

Mitosis

#14

- produces somatic cells (body cells)
- 1 diploid cell makes 2 diploid cells

Interphase happens before mitosis (copy DNA)

Stages of Mitosis

1. Prophase - chromosomes visible, spindle fibers attach
2. Metaphase - chromosomes lined up in center
3. Anaphase - chromatids separate at the centromere
4. Telophase - nucleus reforms, chromosomes spread out

Cytokinesis happens after mitosis

Meiosis

#15

Produces gametes (sex cells: egg/sperm)

1 diploid cell makes 4 haploid cells through 2 divisions

Interphase happens before meiosis (copy DNA)

Meiosis I

(separates homologous chromosomes)

- a. Prophase I: crossing over/synapsis
- b. Metaphase I
- c. Anaphase I
- d. Telophase I

Meiosis II

(separates sister chromatids)

- a. Prophase II
- b. Metaphase II
- c. Anaphase II
- d. Telophase II

Cytokinesis follows Telophase I & II

Sources of Genetic Variation **#16**

1. Recombination of alleles during sexual reproduction
2. Mutations (random change in DNA)
3. Random Assortment of chromosomes during meiosis
4. Crossing-over (Prophase I of Meiosis)
5. Nondisjunction (most commonly trisomy 21 = Down syndrome)
6. Fertilization: 23 mom + 23 dad = 46 you

Punnett Square Vocabulary #17

Dominant : expressed (only need 1 copy)

Recessive: NOT expressed (unless have 2 copies)

Homozygous: same alleles (TT or tt)

Heterozygous: different alleles (Tt)

Phenotype: What it looks like (Tall); "**physical form**"

Genotype: Genetic make-up (TT, Tt, tt); "type o' genes"

Test-Cross: cross to determine if homo or heterozygous for a trait -- must cross with homozygous recessive

Monohybrid Crosses

#18

One trait only

T = tall t = short

Ex) Homozygous Tall (TT) crossed with Heterozygous (Tt)

Gametes	T	T
T	TT	TT
t	Tt	Tt

Phenotypic Ratio: All Tall

Genotypic Ratio: 2 TT : 2 Tt
or 50% TT, 50% Tt

Dihybrid Crosses

#19

Two traits

(shows Mendel's law of independent assortment)

ex) $TtBb \times TtBb$ $T = \text{tall}$ $B = \text{brown}$
 $t = \text{short}$ $b = \text{blonde}$

1. Find Gametes (FOIL) or (1 & 3, 1 & 4, 2 & 3, 2 & 4)
 TB, Tb, tB, tb

2. Use 16-block Punnett Square

3. 9:3:3:1 phenotype ratio

Be able to predict Genotype & Phenotype of specific squares within the cross

Incomplete Dominance vs. Codominance #20

Partial dominance

Results in blending
of two traits

Red flowers (RR)

x

White flowers (R'R')

=

Pink flowers (RR')

Both alleles contribute

Black Feathers (BB)

x

White Feathers (WW)

=

Black & White
(checkered) Feathers
(BW)

Multiple Alleles

#21

more than two alleles for a trait

ex) Blood Type has 3 alleles: I^A , I^B , i (or A, B, o)

A & B alleles are codominant over the o allele

Type A: $I^A I^A$ or $I^A i$

Type B: $I^B I^B$ or $I^B i$

Type AB: $I^A I^B$

Type O: ii

Universal Donor is Type O

Universal Recipient is Type AB

Sex-Linked vs. Polygenic #22

Found on the X chromosome

More common in males (XY)
because they only get 1 X

ex) Hemophilia (lack blood clotting factor); Colorblindness

H = normal h = hemophilia

$X^H X^H$ - normal female

$X^H X^h$ - carrier female

$X^H Y$ - normal male

$X^h Y$ - hemophilia male

Count # of dominant alleles to determine phenotype

ex) skin, eye, hair color

4 dom = black

3 dom = dark

2 dom = med

1 dom = light

0 dom = white

Therefore....

AABB = black

AaBB = dark

Aabb = light

aabb = white

Pedigrees & Karyotypes #23

family record that shows how traits are inherited over many generations

square = male

circle = female

shaded in = shows disorder

usually show sex-linked traits
(most males have disorder)

ordered display of a person's chromosomes

used to determine gender
(23rd pair)

same = XX female

different = XY male

used to determine genetic disorders like Down syndrome
(trisomy 21)

Uses of DNA Technology

#24

DNA Fingerprint = made using Gel Electrophoresis

- separates DNA segments by size (small travel further)
- used to determine paternity & who committed crimes

Cloning

- making genetically identical organisms
- reduces variation :(

Transgenic Organisms (Genetically Modified Organisms)

- genes from 1 organism are transferred into DNA of another organism to provide a useful trait;
- ex) creating plants that are resistant to herbicides or that are drought-tolerant

Making Recombinant DNA #25

1. extract desired gene (usually from human) using restriction enzyme - cut DNA at specific sequences
2. splice (join) desired gene into DNA of a plasmid (circular DNA of bacteria)
3. insert plasmid with desired gene back into the bacteria
4. allow bacteria to reproduce (binary fission) & create identical copies that contain the recombinant DNA

Evolution

#26

Change over time

Simple to more complex: Anaerobic to Aerobic
Prokaryotic to Eukaryotic

Typically answers will be **COMMON ANCESTOR**
or **NATURAL SELECTION**

Mechanisms of Evolution

1. mutation - random genetic change
2. genetic drift - unusual gene more frequent in small population (Amish people)
3. gene flow - migration in/out changes population
4. natural selection

Evidence of Evolution

#27

1. Fossil Record

- a. Relative Dating: lower rock layers have older fossils
- b. Radiometric Dating: gives exact age, uses 1/2 life of radioactive isotopes

2. Biochemistry: more similar DNA or proteins = more closely related

3. Comparative Anatomy

- a. Homologous Structures: different function, similar structure; suggests common ancestor
- b. Analogous Structures: same function, different structure (not common ancestry)

4. Embryology: development very similar; suggests evolution from common ancestor.

Natural Selection

#28

- Darwin's Survival of the Fittest; differential reproductive success

1. Organisms produce more offspring than survive
2. Within population, individuals have variations
3. Those with useful variations survive & reproduce
4. Over time, those with useful variations make up most of the population

Types of Natural Selection

- a. Stabilizing: favors average
- b. Directional: favors 1 extreme (Antibiotic Resistance)
- c. Disruptive: favors both extremes, leads to new species

Classification of Living Things #29

- based on similarities in structure (morphology)
- reflects evolutionary relationships (phylogeny)
- changes as more is learned

Binomial Nomenclature (Latin, underline/italicize)

-use genus & specific epithet ex) Homo sapiens

Remember:

King Phillip Came Over From Germany Suddenly.

Kingdom, Phylum, Class, Order, Family, Genus, Species

More levels in common = more closely related

6 Kingdoms of Organisms #30

Kingdom	Cell Type	Body Type	Nutrition	Examples
Eubacteria	Prokaryotic	Unicellular	Autotrophic & Heterotrophic	<i>E. coli</i>
Archaeobacteria	Prokaryotic	Unicellular	Auto & Hetero	Methanogens
Protists	Eukaryotic	Most Unicellular (some multi)	Auto & Hetero	Amoeba, Euglena, Paramecium, Algae
Fungi	Eukaryotic	Most Multicellular (some Uni)	Heterotrophic	Yeast (uni), Mold, Mushroom (multi)
Plant	Eukaryotic	Multicellular	Autotrophic	Mosses, Ferns, Angiosperms, Gymnosperms
Animals	Eukaryotic	Multicellular	Heterotrophic	Man, Dog, Worm

Plants

#31

Multicellular autotrophs with eukaryotic cells that have chloroplasts & cell walls

2 types

1) Nonvascular

ex) Mosses

2) Vascular (have xylem up for water/ phloem down for food)

ex) Ferns (seedless), Gymnosperms (seeds in cones),
Angiosperms (seeds in flowers; fruits)

Undergo an Alternation of Generations life cycle

Sporophyte (diploid) -- Makes spores

Gametophyte (haploid) -- Makes gametes

Angiosperms -- Flowering Plants #32

- have flowers; seeds in fruit (big advantages)

Male flower part = Stamen (stay men); makes pollen (sperm)

Female flower part = Pistil; has ovary with eggs

Important Vocabulary

- a. Cuticle - waxy leaf covering, conserves H₂O
- b. Stomata & Guard Cells - pores in leaf, allow gas/H₂O exchange
- c. Pollination - transfer of pollen from male to female (insects attracted to bright flowers with fragrant smell; wind)
- d. Tropisms - growth response toward/away from stimulus
ex) Photo- (light), Gravi- (gravity), Thigmo- (touch)

Animal Behaviors #33

Innate

- A. Taxis - movement toward (+) / away (-) from stimulus
- B. Instincts - suckling
- C. Migration
- D. Hibernation (cold)
- E. Estivation (hot)
- F. Social Behavior
 - Pheromones (ants leave scent trail)
 - Courtship Dances (best dance gets girl)
 - Territorial Defenses

Learned

- A. Habituation - loss of sensitivity to certain stimuli (horses & cars)
- B. Imprinting - bonding with mother (ducks)
- C. Conditioning - Pavlov's dog (bell & food)
- D. Trial & Error (fridge good, stove bad)
- E. Insight/Reasoning - problem solving

Important Adaptations

#34

Most develop by Co-Evolution (2 species evolve in response to each other); ex) plants & insects

Plants

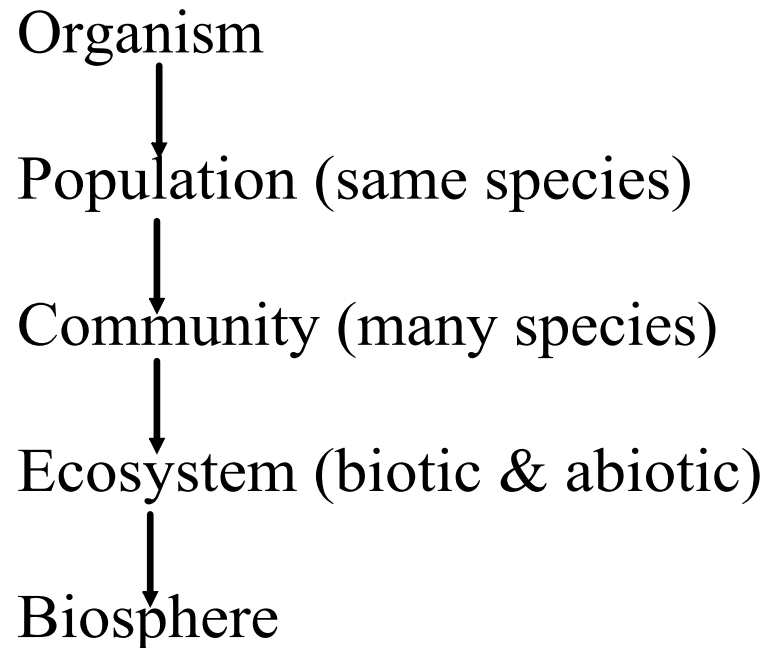
- Vascular Tissue
- Roots
- Stems
- Leaves
- Flowers
- Fruit

Animals

- Speed
- Produce Toxins
- Mimicry (look like more dangerous animal)
- Camouflage (blend in with surroundings)

Levels of Organization & Symbiosis

#35



- A. Mutualism (+, +)
 - both benefit
- B. Commensalism (+, =)
 - one benefits
 - other NOT affected
- C. Parasitism (+, -)
 - parasite benefits
 - host harmed, but NOT killed usually

Limits to Population Growth #36

Types of Growth

- 1) Exponential : J-shaped
- 2) Logistic: S-shaped; stable

Limiting Factors

- A) Density-dependent : effects depend on population size
ex) Disease
- B) Density-independent: effects regardless of size
ex) Flooding, Drought

Abiotic -- Sunlight, Soil, Water, Earthquakes, Tidal Waves

Biotic -- Disease, Predators, Prey, Competition, Symbiosis

Cycling of Matter = Carbon Cycle #37

- Happens through photosynthesis & cellular respiration
(remember formulas - products to reactants)
- Decomposers break down dead organisms & return energy and nutrients like carbon to ecosystem
- Combustion adds carbon to the atmosphere (as CO₂ or CO)

Energy Flow in Ecosystems **#38**

Producers -- organisms that make food (plants/autotrophs)

Consumers -- must eat other organisms (heterotrophs)

ex) Carnivores, Omnivores, Herbivores,
Scavengers & Decomposers

Be able to infer affects of changes within food chain/web

Remember 10% rule:

(10% of energy transferred, 90% lost as heat)

#39

Human Impacts on Environment

- Population growth = resource depletion
- We must develop more sustainable practices to reduce negative impacts
- Pollution by Fertilizers (leads to algae overgrowth in lakes)
- Urbanization (removes habitat); Habitat Destruction is greatest threat to Biodiversity
- Deforestation & burning fuels increases CO₂ levels; Climate Change (increase CO₂ = greenhouse effect -> global warming)
- Ozone Depletion caused by CFCs from industry/refrigerants; more UV rays reaching Earth
- Acid Rain caused by burning fuels with impurities; affects ecosystems

Misc....

#40

- * Distilled Water = 100% Water
- * pH scale: 0-6.9 acid, 7 neutral, 7.1-14 base
- * pH of stomach = 1-2; blood = 7.4; sm. intestine = 9
- * Inorganic compounds = water, salt, carbon dioxide
- * Organic = carbohydrates/protein/lipids/nucleic acids
- * Mitochondria & Chloroplasts have own DNA
- * Type of animal cell that divides the fastest is SKIN Cells (replace every 28 days)
- * Hemoglobin proteins found on red blood cells; carry oxygen